A Guide to
POSTERIOR MEDIASTINAL Masses

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Learning Objectives

1. REVIEW
   ITMIG mediastinal compartment classification and relevant boundaries + contents

2. IDENTIFY
   Posterior mediastinal lesions based on their composition

3. DEPICT
   Imaging findings that are unique to the posterior mediastinal masses
ITMIG Classification of the Mediastinal compartments

- **Prevascular Compartment (Anterior)**
- **Visceral Compartment (Middle)**
- **Paravertebral Compartment (Posterior)**

**Superior**: thoracic inlet
**Inferior**: diaphragm
**Anterior**: posterior boundary of the visceral compartment
**Posterior**: vertical line against the posterior margin of the chest wall at the lateral margin of the transverse process of the thoracic spine

Case: Andrew Dixon rID: 36676

International Thymic Malignancy Interest Group (ITMIG)

Paravertebral soft tissues
Thoracic spine
Classification of posterior mediastinal masses based on their composition

- **NEUROGENIC**
  - Nerve Sheath Tumors
  - Sympathetic Ganglion Tumors
  - Paraganglionic Tumors

- **CYSTIC**
  - Meningocele
  - Foregut Duplication Cyst
  - Hattori Cyst

- **FAT**
  - Lipoma
  - Liposarcoma
  - Lipomatosus

- **VASCULAR**
  - Descending Aortic Aneurysm
  - Aortic Dissection

- **OTHER**
  - Extramedullary Hematopoiesis
  - Lymphadenopathy
  - Infection
SCHWANOMOMMA

Neurogenic

1. Nerve Sheath Tumors:
   - Schwanomma
   - Neurofibroma

2. Sympathetic Ganglion

3. Paraganglionic Tumors

Case: Paul Leong  rID: 26625

50 y/o female

Frontal CXR

SOLITARY, SPORADIC (~90%)
Peak in 5th/6th decade

MULTIPLE, NF-2 (~18%)
Peak in 3rd decade

RADIOGRAPH:
- Well-circumscribed, round paravertebral mass
- Erosion of adjacent bone (vertebrae/ribs)
- Calcification is rare

CT:
- Low to intermediate attenuation
- Heterogenous enhancement (cystic, hemorrhage, fatty degeneration)
- Bony remodeling
- Can extend into intervertebral foramina

MRI:
- T1: isointense or hypointense
- T2: heterogeneously hyperintense (Antoni type A: relatively low; Antoni type B: high)
  - Large tumors: cystic degeneration can be present
**NEUROFIBROMA**

**SOLITARY, SPORADIC**
*Peak between 20 and 30 years*
*No sex predilection*

**MULTIPLE, NF-1**
*Peak during childhood*

**RADIOGRAPH:**
- Appears as **well-defined round or oval paravertebral mass**

**CT:**
- **Well-defined hypodense mass**
- Minimal or no contrast enhancement

**MRI:**
- T1: hypointense
- T2:
  - **hyperintense**
  - Target sign:
    - A hyperintense rim and central area of a low signal may be seen
- T1 C+ (Gd): heterogeneous enhancement

**1. Nerve Sheath Tumors:**
- Schwanomma
- Neurofibroma

**2. Sympathetic Ganglion**

**3. Paraganglionic Tumors**
Mean age of presentation: ~22 months

**Epidemiology:**
- Beckwith-Wiedemann syndrome
- DiGeorge syndrome
- Hirschsprung disease
- NF type 1

**Associations:**
- Nerve Sheath Tumors
- Sympathetic Ganglion
- Paraganglionic Tumors

**Locations:**
- Adrenal glands: most common site ~35%
- Retroperitoneum ~30-35%
- Posterior mediastinum ~20%
- Neck and pelvis ~1-5%

**Neuroblastoma**
- Non-specific, appears as a para-vertebral soft-tissue mass
- Adjacent bony changes can be seen
- Calcification can be seen in 30% of cases
- Bony metastases present as osteolytic with periosteal reaction

**Radiograph**
- 80-90% of cases have heterogeneous appearance with calcifications
- Necrosis appears as areas of low attenuation

**CT**
- Necrosis appears as areas of low attenuation

**Nuclear Medicine:**
1. MIBG: are highly sensitive and specific for sympathetic tissue
2. For Surveillance and metastatic recurrence: Technetium 99m-methyl diphosphonate

Case: Jane McEniery rID: 76428

![Images: Frontal CXR, Axial C+ CT, MIBG]
Neurogenic

1. Nerve Sheath Tumors

2. Sympathetic Ganglion

3. Paraganglionic Tumors

Neuroblastoma

Overview:
- Hereditary paragangliomas: succinate dehydrogenase (SDH) mutations
- Parasympathetic paragangliomas: head and neck
- Sympathetic paragangliomas: below the level of the neck

Associations:
- Von Hippel-Lindau syndrome
- MEN type 2A and 2B
- NF1
- Carney-Stratakis syndrome/carney triad

TO NOTE:
- Both anatomical and functional imaging of paragangliomas are required for diagnosis and staging
- Anatomical imaging: CT and MRI
- Functional imaging modalities: 123I-MIBG scintigraphy, 18F-FDA PET, 18F-DOPA PET, 18F-FDG PET and 68Ga-DOTATATE PET

PARAGANGLIOMAS

RADIOGRAPH
- Well defined paraspinal soft tissue mass

CT
- Strong contrast enhancement with delayed washout

MRI
- T1:
  - hypointense, salt and pepper appearance
- T2:
  - Hyperintense, salt and pepper appearance
- T1 C+ (Gd):
  - heterogenous prolonged enhancement

Case: Charlie Chia-Tsong Hsu rID: 20295

X-ray Frontal CXR

Axial C+ CT
**Cystic**

1. **Meningocele**

2. **Foregut Duplication Cyst**

3. **Hattori Cyst**

**What are they?**

Type of open neural tube defects - meninges herniate through a foramen or defect in the vertebral column

**Associations:** NF-1, HARD (hydrocephalus, agyria, and retinal dysplasia), trisomy 13/18, maternal use of antiseizure medications, maternal low folate intake

**MRI is the GOLD STANDARD test**

- Signal Intensity of CSF fluid
- T1 - Hypointense
- **T2 - Hyperintense**

**CT:**

- Well-circumscribed, low-attenuation paravertebral mass due to CSF content
- Can exhibit peripheral rim enhancement

**Case:** Wen Jak Ma rID: 56105

**T2 Axial MRI**
BRONCHOGENIC CYST

**Cystic**

1. Meningocele
2. Foregut Duplication Cyst: *Bronchogenic*
3. Hattori Cyst

**Epidemiology:**
- 5-10% of pediatric mediastinal masses
- Equal sex predilection

**Location:**
- 70% occur in the mediastinum
- Can be intrapulmonary

**RADIOGRAPH:**
- Rounded soft tissue densities
- Dependent layering of 'milk of calcium' may be seen

**CT:**
- Well-circumscribed ovoid masses of variable fluid attenuation
- CT attenuation often depends on the amount of proteinaceous content

**MRI:**
- T1: Variable signal intensity, from low (~fluid) to high (protein content)
- T2: Usually high signal intensity due to fluid content

**Case:** Hani Makky Al Salam rID: 9372

**Frontal CXR**

**Axial C+ CT**
ESOPHAGEAL DUPLICATION CYST

Cystic

1. Meningocele
2. Foregut Duplication Cyst:
   - Bronchogenic
   - Esophageal Duplication
3. Hattori Cyst

Case: Michael P Hartung rID: 59039

Associations:
- Spina bifida
- Esophageal atresia
- Other duplication cysts of the gut

Epidemiology:
- Increased male predilection

RADIOGRAPH:
- Well-defined soft tissue mass near the esophagus

FLUOROSCOPY:
- Barium swallow: cyst may cause extrinsic compression of the esophagus

CT:
- Well-demarcated fluid density mass along the esophagus

MRI:
- T1: low to intermediate signal intensity
- T2: high signal intensity, fluid levels can be seen
**Cystic**

1. Meningocele

2. Foregut Duplication Cyst

3. Hattori Cyst

**What are they?**

Embryology: Mullerian origin
Incidence: females aged ~40-60 years

**CT:**
- Well-defined *soft tissue mass in the paravertebral area*
- No adjacent bone involvement

**MRI:**
- T1: low signal
- T2: *high signal fluid type*
- T1 C+ (Gd): no significant enhancement

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**HATTORI CYST**

Axial C+ CT

Axial T2

Case: Domenico Nicoletti rID: 95897
# Lipoma and Liposarcoma

## Lipoma

- **Benign tumors**
- ~2% of the population

**Epidemiology:**
- Presents in 5th-7th decades

**X-ray:**
- Soft tissue mass with widening of the mediastinum

**CT:**
- Well defined, low attenuation fat density mass (-65 to -120 HU)

**MRI:**
- T1:
  - high signal
  - saturates on fat-saturated sequences
  - no enhancement
- T2:
  - High signal on FSE T2

## Liposarcoma

- Malignant tumors of fatty tissue
- 2nd most common soft tissue sarcoma

**Epidemiology:**
- Presents in 4th-6th decade

**CT:**
- Heterogenous attenuation (due to soft-tissue within the fatty mass)
- Invasion of adjacent mediastinal structures
- Calcifications can be present

**MRI:**
- Low-grade lesions:
  - Fat signal with thick septa and enhancement, may involve adjacent structures
- Higher-grade lesions: lack of macroscopic fat, invasion of adjacent structures
**MEDIASTINAL LIPOMATOSIS**

**What is it?**
- Deposition of excessive fat in the mediastinum
- Benign condition

**Associations:**
- Steroid use
- Cushing syndrome
- Obesity

**X-ray:**
- Mediastinal widening

**CT:**
- **Unencapsulated fat density lesion** in the mediastinum

**Case:**
- Ahmed Abdrabou
- rID: 50447
DESCENDING THORACIC AORTIC ANEURYSM

1. Descending Aortic Aneurysm
- Aneurysm is when the axial diameter is:
  - >5.0 cm for the ascending thoracic aorta
  - >4.0 cm for the descending thoracic aorta
- Less common than abdominal aortic aneurysms

2. Aortic Dissection
- Mediastinal widening
- Prominent aortic shadow in frontal and lateral CXR

RADIOGRAPH:
- Medialated lumen
- Thickened walls secondary to mural thrombus
- In case of leak or rupture, surrounding fluid or hematoma or fluid is present

EPIDEMIOLOGY:
- Common in 5th-6th decade

ASSOCIATIONS:
- Cerebral aneurysms (~10% prevalence)

Case: Ayush Goel rID: 25313
Case: Craig Hacking rID: 73356
AORTIC DISSECTION

1. Descending Aortic Aneurysm

2. Aortic Dissection

**EPIDEMIOLOGY:**
- Elderly, hypertension
- Connective tissue disorders

**PATHOLOGY:**
- True Lumen: normal lumen lined by intima
- False Lumen: blood-filled channel in the media

**STANFORD CLASSIFICATION:**
- **Type A:** proximal to the origin of the left subclavian artery
- **Type B:** distal to the left subclavian artery origin

**X-RAY:**
- Widened mediastinum at the level of the aortic knob
- Double aortic contour
- Inward displacement of atherosclerotic calcification
- Calcium Sign > 1 cm

**Angiography:**
- Was the gold-standard but CTA has replaced it

Case: Paul Simkin rID: 26373

Frontal CXR

Frontal CXR
1. Descending Aortic Aneurysm

2. Aortic Dissection

CT:
- CTA of the aorta is the GOLD STANDARD test
- Used for classification
- True lumen:
  - Usually smaller with high density of contrast
  - Celiac trunk, SMA, and right renal artery usually arise from the true lumen
- False lumen: Larger in size with low density of contrast

NON-CONTRAST:
- High-density mural hematoma visible
- Displacement of atherosclerotic calcification into the lumen

CONTRAST:
- Double lumen
- Intimal flap
- Mercedes-Benz sign is seen in “triple-barrelled” dissection

MRI:
- Used for follow-up
- Non-contrast techniques can be used for patients with impaired renal function
EXTRAMEDULLARY HEMATOPOESIS

Affects patients with chronic anemia or myeloproliferative disorders

1. Extramedullary Hematopoiesis
2. Lymphadenopathy
3. Infection

**CXR**
- Smooth, well delineated lobulated mass in the paraspinal region
- Unilateral or bilateral

**CT**
- Smooth bilateral paraspinal masses with soft tissue attenuation
- Expansion of marrow spaces of the ribs and vertebrae
- Fat attenuation

**MRI**
- T1
  - Intermediate signal
- T1 with contrast
  - Variable enhancement
- T2
  - Intermediate to high signal intensity
  - Hypointense (iron content from repeated transfusions)

Case: Saikat Sarkar rID: 25025
Case: Bahman Rasuli rID: 74552
Case: Khaloud Alghamdi rID: 78893
 Mediastinal Lymphadenopathy

**ETIOLOGY:**
Secondary to:
- Malignancy
- Infection
- Occupational lung disease
- Connective tissue disorders
- Non-lymphomatous pulmonary lymphoid disorders

**SIZE CRITERIA:**
- Cut-off: 10mm short-axis diameter

**ACR RECOMMENDATIONS:**
- Incidentally detected lymph node of >15 mm with no associated condition should be worked up with PETCT + follow up CT chest in 3-6 months

**RADIOGRAPH:**
- Soft-tissue density with widened mediastinum
- Lobulated hypodense areas
- Post contrast enhancement can be seen based on the etiology

Case: Mohamed Mahmoud Elthokapy rID: 150780

Axial C + CTPA
INFECTION: PARASPINAL ABSCESS

Paraspinal abscess are commonly caused by bacterial/fungal infections and tuberculosis.

**TUBERCULOUS ABSCESS:**

**EPIDEMIOLOGY:**
- Common in old age
- Increased risk in diabetes, IV drug abuse, and spinal instrumentation

EVALUATION:
- Sagittal T1 C+ fat sat
- Axial CT
- MRI:
  - T1: hypointense marrow in adjacent vertebrae
  - T2: hyperintense marrow, disc, soft tissue
  - T1 C+ (Gd): marrow, subligamentous, discal, dural enhancement

RADIOGRAPH:
- A reduction in vertebral height is often seen with the irregularity of the anterosuperior endplate
- Commonly involves thoracolumbar spine but can involve any level
- Ivory vertebrae due to re-ossification.
- Gibbus deformity of the spine
- Vertebra plana

CASE: Andrew Dixon rID: 9354

**1. Extramedullary Hematopoiesis**

**2. Lymphadenopathy**

**3. Infection**
INFECTION : PARASPINAL ABSCESS

1. Extramedullary Hematopoesis
2. Lymphadenopathy
3. Infection

**PYOGENIC ABSCESS:**
- Commonly involves lumbar spine
- Single level involvement is most common
- Can be seen at multiple contiguous levels

**Case:** Bruno Di Muzio rID: 44923

- *Axial CT*
- *Coronal MRI*

**RADIOGRAPH:**
- Disk space narrowing
- Irregular definition of the vertebral endplates
- Bony sclerosis can appear at later stages
  - **CT:**
    - Vertebral endplate irregularity with loss of disc space
    - Enhancing surrounding soft tissue swelling/abscess
  - **MRI:**
    - Intervertebral disc enhancement with contrast

T1: Low signal in disc and adjacent endplates

T2:
- High signal in disc space and adjacent endplates due to bone marrow edema
- High signal in paravertebral soft tissues
- Loss of cortical low signals at endplates

T1 C + (Gd):
- Peripheral enhancement around fluid collection and paravertebral soft tissue
The ITMIG classification is based on cross-sectional imaging. It divides the mediastinum into 3 compartments: prevascular, visceral, and para-vertebral.

Posterior Mediastinal lesions can be classified based on their anatomical origin or their tissue content: fat, fluid, lymph nodes etc.

CT and MRI can be used to determine specific tissue characteristics and their relationship with the adjacent anatomical structures.
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